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SOME NEW ORDOVICIAN TRILOBITES.

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No. 2.— *Some New Ordovician Trilobites.*

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The following brief descriptions of certain new species of trilobites are abstracted from a larger manuscript, the publication of which has been postponed to allow the preparation of adequate illustrations. It has become necessary to use some of these names in another connection, hence this preliminary paper.

Trinucleidae Emmrich.

Trinucleus acervulosus, sp. nov.

Entire test flattened, subcircular in outline, cephalon twice as wide as long, with a narrow fringe. Glabella flask-shaped, narrow, bulbous in front, constricted to a narrow, low neck behind. There are three pairs of glabellar furrows beside the neck-furrow, two pairs showing as deep pits in the "neck," and one pair as small indentations back of the middle of the "bulb." Fixed cheeks evenly convex, without eyes or eye-lines. Surface of glabella and cheeks reticulate. Fringe narrow, marked by radiating grooves separated by rounded ridges of about their own width. In the bottom of each groove are two pits, the anterior of which is the larger. At the genal angles the fringe widens and is marked by a number of irregularly placed, small pits. No specimen has been seen which retains genal spines, but they were undoubtedly present, as there is a long spine on one of the slabs.

Thorax of six narrow segments of the usual form in the family.

Pygidium a little more than twice as wide as long, somewhat angular in outline on the posterior margin, nearly flat, with an abruptly deflected smooth border. Axial lobe narrow, not strongly elevated, with twelve to fifteen narrow rings separated by narrow, sharp furrows. Pleural lobes flat, with eight or nine pairs of ribs, each bearing a broad deep furrow.

Measurements:— The holotype is 19 mm. long, 19 mm. wide at the genal angles; the cephalon 8 mm. long, thorax 5, and pygidium 6 mm. long. The bulb of the glabella is 5 mm. wide; the axial lobe of thorax 3 mm. wide; the pygidium 13 mm. wide. The fringe is 1 mm. wide, and there are twelve grooves in 5 mm. Another specimen is 19 mm. long and 18 mm. wide, and a third 12.5 mm. long and 12 mm. wide.

This species, the first American representative of the genus to be known from complete specimens, is more like *Trinucleus diademata* (Ruedemann) than any other allied form. Ruedemann's species

from the boulders at Rysedorph Hill was described from an incomplete cephalon, so that detailed comparison is not possible. It would appear, however, that our species has a narrower fringe and less prominent glabella than specimens from the New York.

Trinucleus fimbriatus Murchison, the type of the genus as restricted, is very similar to *T. acervulosus*, but differs in having more pits in the fringe, particularly at the genal angles. *T. fimbriatus* is probably from about the same horizon (Llandeilo) as our species.

Horizon and Locality:— Numerous specimens have been collected by Prof. Roy Holdon from the Athens shale three miles northeast of Blacksburg, Va. Holotype M. C. Z. 1,592.

Dionideidae, fam. nov.

Dionideae Gürich, Centrabl. min. geol. pal., 1907, p. 135 (*nomen nudum*).

Dionide has usually been placed with Trinucleus and Ampyx in the Trinucleidae. The structure is, however, not in accord with either of those genera and since they have been separated, Dionide can not logically be placed in either family. The free cheeks are ventral like those of the Trinucleidae but the cephalon does not have a regularly pitted brim and the pygidium is very large. The family may be diagnosed as follows:—

Isopygous hypoparia with six segments in the thorax and both shields large. Free cheeks ventral except for the genal spines. Surface of cephalon irregularly pitted. Hypostoma short, rounded, tuberculated.

One genus, Dionide, Barrande. Ordovician, Europe and North America.

Dionide holdoni, sp. nov.

Animal of medium size for the genus; test oval in outline, about one fifth longer than wide.

Cephalon short, about three times as broad as long. Glabella relatively short, reaching only two thirds the length of the cephalon, moderately convex in outline, smooth except for the small median tubercle and a larger spine-base back of it. At the sides of the glabella there are faint indentations of a pair of lateral furrows, and at the back is a pair of short longitudinal ones. These latter are somewhat longer in young specimens than in the adults. Fixed cheeks depressed convex, covered with a fine network of irregular radi-

ating branching ridges and small shallow pits. The two principal "nervures" originate on either side of the glabella just in front of the lateral furrows and run diagonally backward, reaching the neck-furrow some distance inside the genal angles. Those on the right cheek of one specimen not only branch, but in the outer part of their course, the two unite, showing conclusively that they are not facial sutures. The cephalon has a narrow, upturned rim around its border, and in the concentric depression within this is a row of pits which are larger and deeper than the others on the cephalon. The neck-furrow is linear, clearly impressed and the neck-segment smooth. As usual in the genus, the facial suture is marginal except at the genal angles, where it cuts off the spines. These latter are not satisfactorily preserved on any specimens but apparently were not long enough to reach beyond the third thoracic segment, a very unusual feature in this genus, and leading one to suspect that the specimens are incomplete in this regard.

Thorax with six narrow segments, the first of which is a little wider than the succeeding ones, but not differently marked. Axial lobe narrow, each ring showing the diagonal furrow at the sides as is usual in the genus. The furrows on the pleural lobes divide each lateral portion of a segment into an anterior area which is pitted like the fixed cheeks, and a narrower smooth posterior part.

The pygidium is about twice as wide as long, rounded in outline, with, in some cases, sufficient straightness of sides to produce a slight triangularity. Axial lobe narrow, with about fifteen rings, and pleural lobes with about twelve pairs of furrowed ribs which extend to the edge. Surface pitted, like that of fixed cheeks.

Measurements:— One specimen is 15.5 mm. long, 13 mm. wide at the genal angles. The pygidium is 5.5 mm. long, 11.5 mm. wide, thorax 4.5 mm. long, cephalon, 5.5 mm. long. Another specimen is 15 mm. long, and 12.5 mm. wide. A third specimen is 19.5 mm. long, and 15 mm. wide.

A cephalon is 6 mm. long and 18 mm. wide; distance from back to front of glabella, 4 mm., width of glabella 4.5 mm.

This species is more like *Dionide richardsoni* Reed than any other known species of the genus. The likeness is emphasized particularly by the ornamentation of the thorax. It has, however, fewer rings and ribs on the pygidium, a wider cephalon and narrower axial lobe. The ornamentation of the thorax and pygidium separates it from all other species.

Horizon and Locality:— This species has so far been found only at a locality about 100 feet below the top of the Athens shale about three miles northeast of Blacksburg, Va., where it was collected by Professor Holden, for whom it is named. The associated fossils are typical Normanskill graptolites, brachiopods, and trilobites. Holotype M. C. Z. 1,590.

Dionide contrita, sp. nov.

This species is represented by only a single specimen, a rather poor pygidium to which are attached parts of two segments of the thorax. It would not be worthy of description were it not for the fact that it belongs to the group with large pygidia.

Cephalon not yet known.

Thorax with narrow axial lobe and short segments, the outer ends of which turn backward.

Pygidium large, nearly semicircular but not quite twice as wide as long. Axial lobe narrow, tapering gradually and regularly. The last four millimeters of the axis are broken off, but the anterior part shows eighteen rings, and there were apparently about twenty-four pairs of ribs on the pleural lobes, these being especially crowded at the posterior end.

Measurements:— Length of pygidium, 14.5 mm., width about 24 mm. The axial lobe is 5 mm. wide at the front.

Horizon and Locality:— The only known specimen was collected by the writer about 100 feet above the bottom of the Athens shale near the Thomas farm three miles northeast of Blacksburg, Va. Holotype M. C. Z. 1,591.

Raphiophoridae Angelin.

Raphiophorus powelli, sp. nov.

Entire test broadly oval, nearly as wide as long. Cranidium approximately semicircular in outline, the glabella projecting slightly in front of the cheeks. Glabella obovate, prominently convex, with a small spine directed forward and upward. At the base of the glabella there are two small narrow lobes, cut off by the posterior glabellar furrows. Fixed cheeks depressed convex. Free cheeks missing, but evidently narrow. Thorax with five segments, each pleuron bearing a deep linear, straight, median groove. Pygidium short and wide, with abruptly deflected posterior border. The pleural lobes bear two pairs of faintly defined ribs which curve backward to the margin.

Measurements:— Length, 10.5 mm., width 9 mm. Length cephalon 5 mm., width 9 mm. Width glabella at front, 3 mm., at back 2 mm. Length thorax 2.5 mm., width axial lobe 2 mm. Length pygidium, 2.5 mm. (*circa*), width 8 mm.

This species most nearly resembles *R. semicostatus,* differing only in having a less rapidly expanding glabella, in the presence of glabellar

lobes, and in the pygidium, which has fewer and curved, instead of straight, ribs.

Horizon and Locality:—Aside from the typical region, the Catawba Valley, Va., I have also found this species at Saltville, in the lower part of the Athens, and in yellowish calcareous shales near the railroad station at Bull's Gap, Tenn. Holotype 1,598 M. C. Z. Paratype M. C. Z. 1,599.

Endymioniidae, fam. nov.

This family is erected for species which resemble the Raphiophoridae in the possession of narrow free cheeks without eyes, and a short Ampyx-like pygidium, but lack a glabellar spine. The typical genus is Endymionia. The family may be briefly characterized as follows:—

Hypoparia with narrow dorsal free cheeks but no eyes, no glabellar spine, seven segments in the thorax, short ampycid pygidium.

Ordovician, Quebec, Newfoundland, Scotland, and Sweden.

Endymionia Billings. Cephalon evenly convex with large glabella divided into three parts by a pair of longitudinal furrows. Axial lobe of thorax about one third the total width.

Type, *Endymionia meeki* Billings.

Lower and Lower Middle Ordovician, Quebec, and Newfoundland.

Anisonotus, gen. nov. Cephalon irregularly convex, glabella small, with lateral furrows indicated by pits. Axial lobe of thorax narrow.

Type, *Shumardia glacialis* Billings.

Lower and Lower Middle Ordovician, Newfoundland, Scotland, Sweden. Other species which appear to belong to this genus are *Anisonotus hornei* (Nicholson and Etheridge) from the Balclatchie (Llandeilo) of Scotland and *A. obtusus* (Moberg and Segerberg) from the Ceratopyge shales of Sweden.

Endymionia schucherti, sp. nov.

Endymionia meeki Billings (*partim*). Palaeozoic foss. Canada, 1865, **1**, p. 281.

Specimens of this species are larger than those of *E. meeki*, with smooth rather evenly convex cephalon, and flattened thorax and pygidium. Lengths of cephalon, thorax, and pygidium in the proportion 2 : 2 : 1.

Cranidium a little more than twice as wide as long, smooth, gently and evenly convex. Glabella very large, depressed convex, with large lateral lobes strongly suggestive of Amphilichas. The outline of the whole glabella is roughly circular, the width being a little greater than the length of the glabella and neck-ring. The confluent glabellar furrows follow exactly the same course as do those of an Amphilichas, separating large, oval, diagonally placed lateral lobes. The central lobe is narrowest a short distance in front of the neck-furrow, and widest at the front. In front of the glabella the cheek slopes down to a very narrow flattened or concave border which is absent from the sides, where narrow, free cheeks extending back to the genal angles and probably elongated into genal spines were probably present. No evidence of the presence of eyes remains, and it is probable that like the Raphiophoridae these were blind trilobites with dorsal facial sutures. The neck-furrow is distinct all across the back of the cephalon, but narrow. The neck-segment is wider near the distal ends than near the axial lobe.

The thorax has seven narrow segments, the axial lobe being gently convex and the pleural lobes flat. The axial lobe is rather wide, nearly one third the total width and tapers very little from front to back. On the pleural lobe each segment shows a rather wide, deep, central furrow.

The pygidium is short, Ampyx-like, with four rings on the wide axial lobe and three pairs of ribs on the pleural lobes, and is surrounded by a steeply sloping striated border.

Measurements:— Entire specimen; length, 10 mm., width at genal angles, 9 mm.; length cephalon, 4 mm., thorax 4 mm., pygidium 2 mm., width glabella 3.75 mm., width axial lobe at front of thorax 2.5 mm., at front of pygidium 2 mm., width pygidium at front 6.5 mm. Largest cranidium, length 9 mm., width 15 mm., width glabella 8 mm., length glabella 7.5 mm.

This species is very like *E. meeki*, and I should not have been able to separate the two had not specimens of both been before me. In *E. schucherti* the glabella is more nearly circular in outline, broader, and flatter than in *E. meeki*, and the median tubercle is fainter and farther forward, so faint in fact as to be invisible on most specimens. In *E. meeki* there is a strongly striated abruptly sloping border in front of the glabella while in *E. schucherti* the corresponding portion is a smooth "roll" sloping down to a narrow concave border.

Horizon and Locality:— Professors Schuchert and Twenhofel collected twelve specimens, three of them entire, from the limestones of Division N, (Normanskill) at Table Head, Newfoundland. Billings referred to this form as occurring abundantly in Division N at Table Head and the west side of Pistolet Bay, also in Division P, four miles northeast from Portland Creek, Newfoundland. The types are in the Yale University Museum. Named for Prof. Charles Schuchert.

Anisonotus, gen. nov.

Anisonotus glacialis (Billings).

Shumardia glacialis Billings, Palaeozoic foss. Canada, 1865, **1**, p. 238, fig. 270.

Entire trilobite oval in outline, nearly as wide as long, the greatest width being at the back of the cephalon. The cephalon is strongly convex; the thorax and pygidium nearly flat except for the axial lobe, which is narrow and elevated.

The cephalon is trinuclear, the swollen glabella rising above the mound-like fixed cheeks. The glabella extends two thirds of the length of the cephalon (measured on the curvature) and shows at the sides four pairs of pits. The last pair represent the neck-furrow, and the others the fourth, third, and second pairs of glabellar furrows. The first and fourth pairs of pits are much less conspicuous than the others. The elevated glabella is bounded by a pair of narrow furrows which converge backward and outside these is a pair of furrows which are parallel to the axis of the head. Between the parallel and the converging furrows are a pair of only slightly elevated triangular ridges, the apices pointed forward.

Outside the parallel furrows on the cephalon there are two evenly rounded mounds, limited on the inside and back by straight furrows intersecting at right angles and at the front by a curving depression which joins the dorsal furrows opposite the anterior glabellar furrows. In this depression there is on each side a narrow but distinct eye-line which curves backward around the mound and continues to the border of the cheek, meeting it at the horizon of the neck-furrow. In front of this furrow and in front of the glabella there is a rather abrupt bulging slope to the margin, which appears to be somewhat thickened, but probably without rim or brim. The type being exfoliated, gives the appearance of a very narrow brim on the front.

At the genal angles the fixed cheeks are drawn back into short lapets which extend behind the neck-ring. These lapets are semicircular in outline, and it is difficult to decide whether they are the actual genal angles, or whether they were enveloped by spines belonging to the free cheeks. In front of the angles there is a slight sinuosity in the side of the cheek, and along this part the border which is present on the front of the cephalon is absent. This seems to indicate that free cheeks should be present, but very narrow ones as in most species of Ampyx. These cheeks would probably have borne the genal spines.

The anterior portion of the cephalon is covered with very fine wavy lines parallel to the anterior edge.

The thorax has seven segments, and does not taper from front to back. The axial lobe is narrow, one fifth of the total width, and strongly elevated. The pleural lobes are flat, each pleuron bearing a linear groove whose course is at right angles to the axis. The first two segments do not extend quite so

far at the sides as those behind — a common condition in trilobites with genal spines.

The pygidium is nearly semicircular, but has the somewhat triangular appearance so often seen in pygidia of ampycids or trinucleids. The axial lobe is narrow, elevated, and extends almost to the posterior border. The pleural lobes are flat, and turn down but little to the very narrow thickened margin. Singularly enough, there is a ring on the axial lobe for each pair of ribs on the pleural lobes, so that rings and ribs are continuous. Nine distinct rings are present. The ribs are narrow and flat, with just a suggestion of an impressed line along the top.

Measurements:— Length 14.5 mm., greatest width, 13 mm., width at middle of thorax, 10.5 mm. Length of cephalon 6.5 mm., width 13 mm.; length glabella 4.5 mm., width of glabella at front 3.25 mm. Length of thorax 4 mm., width 10.5 mm.; width of axial lobe 2 mm. Length of pygidium 3.25 mm., width at front 9 mm.; width of axial lobe at front 1.5 mm. A flattened cephalon is 6 mm. long, 15 mm. wide, and the glabella is 4.5 mm. long.

This species differs in many respects from *Endymionia meeki*. The glabella is shorter and considerably narrower, has four instead of two pairs of pits at the sides, and has much less prominent lobes beside it. *E. meeki* does not seem to have the mound-like cheeks, and eye-lines are absent. The axial lobe of the thorax is much narrower in *A. glacialis* than in *E. meeki*, and the furrows on the pleura are straight instead of sinuous. The pygidium of the present species has a narrower axial lobe and more rings and ribs than in the Beekmantown form.

With the knowledge of this specimen it is possible to get a better idea of the characteristics of the Endymionidae. The form of the thorax and pygidium and the presence of narrow free cheeks approach very closely to the Raphiophoridae, being excluded from that family as now defined only by the shortness of the glabella and the absence of a long spine therefrom.

Horizon and Locality:— Billings's specimens came from the conglomerates of Portland Creek and Pistolet Bay, Newfoundland. Hyatt found it on the east side at Port au Port, and Schuchert and Twenhofel obtained three fragments from the same locality. The horizon is their zone 6, Normanskill. Genoholotype M. C. Z. 1,594.

Olenidae Burmeister.

Triarthrus caecigenus, sp. nov.

Entire test oval, of the usual shape in this genus, without spines or pustules except for a small one on the neck-ring.

Cephalon somewhat irregular in outline, the glabella projecting in front of the cheeks. Glabella long and wide, with a very narrow circumglabellar furrow and a very narrow upturned border. There are two pairs of glabellar furrows which run inward and somewhat backward and are deeply impressed, particularly at their inner ends. Fixed cheeks narrow, with a somewhat wide convex marginal border which extends around the sides and connects with the neck-ring. A truncation of this border at the sides suggests the possible former presence of very narrow free cheeks, but there are no traces of palpebral lobes.

Thorax with (apparently) eleven segments. Axial lobe wide and the rings smooth.

Pygidium strongly segmented, with about six pairs of ribs on the pleural lobes and seven rings on the axial lobe.

Measurements:— Length, 11.5 mm. Length cephalon, 3.5 mm., thorax, 5.5 mm., pygidium, 3 mm. Width at genal angles, 6 mm., width glabella, 3 mm., width axial lobe at front 2.75 mm., width pygidium 4 mm.

This species can be distinguished from all others by the absence of eyes. The most closely allied species is *Triarthrus humilis* Hadding which has the eyes far forward and the free cheeks very narrow.

Horizon and Locality:— A rather common species in the Athens shale in the Catawba valley north of Salem, Va., where the type was collected by Prof. S. L. Powell, and also at Laskers Gate, three miles northeast of Blacksburg, Va., where it was collected by Dr. R. M. Field and the writer. A few specimens were also found at Saltville, Va., near the base of the Athens. Holotype M. C. Z. 1,593.

Remopleuridae Corda.

Robergia major, sp. nov.

Cephalon large, rounded in front, wider than long, with long narrow spines at the genal angles.

Glabella elongate, a little expanded in front of the long eyes, with three pairs of furrows on the wide portion between the eyes. In front of the glabella there is an extremely narrow flattened border. Free cheek narrow, extended backward into a narrow spine of about its own length.

Hypostoma bifurcated, with two very long prongs, as in Remopleurides.

Thorax known from two incomplete specimens, the larger with nine segments. Judging from these specimens the thorax is long, narrow, with very little taper. The axial lobe is wide, convex; the side lobes flat and narrow, the individual segments ending in short spines.

Pygidium nearly square, as long as wide, sides straight and slightly convergent. Axial lobe elevated, extending three fourths of the length, wide

at the front, tapering regularly backward. There are four well-marked rings. Pleural lobes practically flat, apparently crossed by obscure ribs, but all specimens are exfoliated, showing a wide striated doublure. The posterior margin shows two pairs of short flat spines, the inner ones being wider than the outer, and extending practically as far back.

Measurements:— A large cranidium is 15.5 mm. long, and 15 mm. wide at the palpebral lobes. Nine segments of a thorax are 7.5 mm. long, 4 mm. wide at the anterior end and 3.5 mm. wide at the posterior. The axial lobe is 2.5 mm. wide at the front. A pygidium is 10 mm. long, 10 mm. wide at the anterior end and 9 mm. wide at the posterior end. The axial lobe is 5 mm. wide at the anterior end and 7.5 mm. long.

This species is exceedingly abundant in the Athens at Saltville, Va., and though no complete specimens have so far been found, it is now known from all the parts, including the hypostome, which cannot be said of any other species of the genus. It differs but little from *Robergia schlotheimi*, such differences as there are being in the pygidium, which has a longer and wider axial lobe, is more nearly square, and has a straighter posterior margin. It differs from the Swedish *R. micropthalma* chiefly in the pygidium which is much more nearly square and has two instead of three pairs of spines.

Horizon and Locality:— A very abundant species in the lower part of the Athens at Saltville, Va., but not yet found elsewhere. Cotypes M. C. Z. 1,601 to 1,606.

Styginidae, fam. nov.

Approximately isopygous Opisthoparia with glabella greatly expanded at the front, anterior portions of the facial sutures widely divergent, eyes typically very far back. Thorax of nine segments in the typical genus. Pygidium with well-defined, long axial lobe, pleural lobes smooth or with faint furrows.

Stygina Salter. Glabella only faintly outlined, without furrows. Eyes close to posterior margin.

Type, *Stygina latifrons* (Portlock).
Ordovician, Scandinavia, and British Isles.

Bronteopsis Nicholson and Etheridge. Glabella strongly outlined, with or without three pairs of furrows. Eyes close to posterior margin.

Type, *Bronteopsis scotia* Nicholson and Etheridge.
Ordovician, Sweden, Great Britain, and eastern North America.

Holometopus Angelin. Glabella strongly outlined. Eyes about their own length from the posterior margin.

Type, *Holometopus limbatus* Angelin.
Lower Ordovician, Scandinavia and eastern North America.

Bronteopsis gregaria, sp. nov.

Holometopus angelini Billings (*partim*), Palaeozoic foss. Canada, 1865, **1**, p. 281. *Non*, p. 95, fig. 85.

Cranidium much expanded at the front, so that it is wider than long. Glabella convex, prominent, expanded at the anterior end, the width there being equal to about three fourths the length. The glabella tapers rapidly toward the narrowest place, at the neck-ring, and has an obscure median carina on its posterior half. In the dorsal furrows are obscure indications of three pairs of pits, one pair close to the anterior margin and two pairs on the constricted "neck" of the glabella, these being obscure glabellar furrows. The fixed cheeks form wide flattened bands on either side of the glabella and opposite its narrow part, are raised nearly or quite as high as the glabella itself. The neck-ring bears a small median tubercle.

Pygidium approximately semicircular in outline, convex, with a narrow concave border. Axial lobe long, the acutely tapering posterior end continuing though only faintly raised, to the border. At the anterior end of the axial lobe are three well-defined rings, behind which there are two or three rather obscure ones. The pleural lobes are smooth, except for an anterior rib. The smaller specimens are nearly flat, and the posterior portion of the axial lobe more clearly defined than in the large ones.

Measurements:— Length cranidium, 7.5 mm., width at front, 9 mm. Width glabella at front, 5.5 mm., at neck furrow, 3.5 mm. Length pygidium 4 mm., width, 7.5 mm.

Horizon and Locality:— The types are from the base of the Liberty Hall limestone at Lexington, Va., where the species is common. It is also common at the top of the Holston at the Thomas farm, three miles northeast of Blacksburg, Va., and in the Athens at Chatham Hill, on the northern slope of Walker Mountain, north of Marion, Va. A single specimen was found above the middle of the Holston on the Hoge farm seven miles south of Bland, Bland Co., Va., and another single specimen in the middle Ottosee, seven miles north of Mendota. Specimens from these three localities are in entire agreement. In Tennessee I found it at only one locality, between the Holston and Tellico, in South Knoxville.

In Newfoundland Schuchert and Twenhofel found this species in zones M_2, N_1, and the Isolated limestone, all at Table Head. These specimens differ from the ones described above in having the cranidium a little shorter and broader, the posterior part of the glabella a little wider, and a slightly shorter axial lobe on the pygidium. Specimens nearer these than the other Virginian specimens were collected by Dr. Shuler on the northern side of Walker Mountain near White Gate, Bland Co., Va.

This species is much more nearly related to *Bronteopsis ardmillanensis* Reed, than to the type of the genus. The Scottish species has a slightly different conformation of the fixed cheeks and more traces of ribs on the pleural lobes of the pygidium, but the differences between the two species are small. *B. nitens* Wiman, obtained from boulders of the older Chasmops limestone, has a somewhat wider glabella and a more acutely triangular axial lobe on the pygidium than our species. Cotypes M. C. Z. 1,595 to 1,597.

Asaphidae Burmeister.

Nileoides, gen. nov.

Some years ago I described (Annals Carnegie museum, 1910, **3**, no. 1, p. 69, pl. 18, fig. 7, 8. Seventh rept. Vermont state geologist, 1910, p. 224, pl. 38, fig. 7, 8. Trans. Roy. soc. Canada, 1912, ser. 3, **5**, sect. 4, p. 119, pl. 2, fig. 8, pl. 3, fig. 1) *Nileus perkinsi* found in the Upper Chazy on Isle La Motte, Vt. While evidently closely allied to Nileus, this species differs from all other species of that genus in having the eyes relatively small and particularly in having them very far back. Another peculiarity is the strong development of the vertical suture on the doublure. I have examined with care great numbers of specimens of Nileus from Norway and Sweden without ever finding this suture, nor does it show in any of the American specimens. The strong development in *Nileoides perkinsi* is therefore of considerable importance.

Cephalon Nileus-like, glabella not outlined, cranidium smooth, gently convex, elongate, not abruptly inflected in front of the eyes. Eyes large, but not so large in proportion to the length of the cephalon as in Nileus. Vertical suture present. Axial lobe of thorax wide.

Type, *Nileus perkinsi* Raymond. Upper Chazy, Vermont.

Hyboaspis gen. nov.

This name is proposed for a curious trilobite in the pygidium of which are combined the elongate form of the asaphid and the short axial lobe of the illaenid. I know of no asaphid with short axial lobe on the pygidium and only in Actinolobus among the Illaenidae is there any hint of elongation of the pygidium and even there nothing comparable to what is seen in the form now to be described. While the ascription of the genus to either the Asaphidae or Illaenidae cannot positively be made until the cephalon is found, I have for the present placed it with the Asaphidae.

Hyboaspis shuleri, sp. nov.

Cephalon and thorax unknown.

Pygidium elongate, narrow, highly convex, turned up somewhat at the posterior end. Axial lobe low, not sharply outlined, without rings, a trifle more than one third the total length. Pleural lobes steep-sided, with narrow concave border, which does not extend around the posterior end. No traces of ribs, except for the anterior one. Surface of pleural and axial lobes crossed by wavy cracks which have a course approximately at right angles to the axis. Doublure wide, especially at the posterior, where it extends halfway to the front, and marked by strong but widely separated terrace lines.

Measurements:— The largest pygidium is 73 mm. long and about 56 mm. wide. The smallest is 22 mm. long and 21 mm. wide. In the large specimen the axial lobe is 25 mm. long. In the small one it is 8 mm. in length.

I know of no trilobite with which this can be compared.

Horizon and Locality:— Only three pygidia of this species have so far been found, two by Dr. E. W. Shuler in 1914 and one by the writer in 1917. All came from the middle of the Holston in the McNutt quarry at Sharon Springs, Bland Co., Va. Cotypes M. C. Z. 1,587, 1,588.

Homotelus, gen. nov.

Onchometopus Raymond and Narraway, *non* Schmidt.
Isotelus (*partim*) of authors.

The generic name Onchometopus was first applied (Ann. Carnegie mus., 1910, **7**, no. 1, p. 51; Raymond, *Ibidem*, p. 63) to an American trilobite by Raymond and Narraway in describing a new species from

the Middle Ordovician of Minnesota and Pennsylvania. The essential features of the trilobites for which this name has been used are the isoteliform glabella and sutures, but asaphiform lack of concave borders on the shields. Since my attention was first directed to this combination of characteristics wider experience has shown that they form a large group in the Middle and Upper Ordovician and that while similar to the Russian Onchometopus they are probably not congeneric with it. The two genera form one more example of that "Parallelism among the Asaphidae" to which I have already called attention (Trans. Royal soc. Canada, 1912, **5**, sect. 4, p. 111). Detailed study with large numbers of specimens indicates that Onchometopus is a derivative of Asaphus, while Homotelus sprang from Isotelus, not once merely, but probably several times. Homotelus differs from Isotelus chiefly in lacking the concave borders on the shields. Often specimens are found in which concave borders are feebly or sometimes even well developed, indicating that this characteristic is one of suppression and showing readily how a Homotelus could have been evolved time after time from various species of Isotelus. Homotelus cannot then be regarded in a strict sense as a good genus, but is a convenient term for a number of species showing similar characteristics.

At the time of our first use of Onchometopus, Mr. Narraway and I pointed out that the American species which we referred to the genus did not have the peculiar hooked doublure which Schmidt considered the most important feature. In 1914 it was my privilege, aided by the Shaler Memorial fund, to collect Onchometopus from the typical localities south of Lake Ladoga, and direct comparison of specimens is now possible. Cephala of American and Russian forms are exceedingly alike in smoothness of glabella, position of eyes, course of facial sutures, and shape of fixed and free cheeks. Doublures are strikingly different not only in the hooked and furrowed character of the Russian form, but also in its narrowness. Greater differences are seen in the thorax, where Onchometopus shows the high narrow rings of an Asaphus while the Homotelus has the broader and flattened rings of the Isotelus. The pygidia again are similar but that of Onchometopus is generally shorter and more nearly semicircular.

As the type of Homotelus I am selecting a species from the Eden of the region of Cincinnati, chosen because of the excellent material available, and named *Homotelus ulrichi* for Dr. E. O. Ulrich of the U. S. Geological Survey.

Homotelus ulrichi, sp. nov.

Outline of entire animal oval, whole surface rather evenly convex, the eyes being the only conspicuous prominences. Cephalon and pygidium about equal.

Cephalon twice as wide as long, nearly semicircular, but since the outline comes just within the semicircle passing through the anterior point and genal angles there is a suggestion of triangularity. The glabella is smooth, not differentiated. On an occasional specimen there are two pairs of pits between the eyes, the vestiges of two pairs of glabellar furrows. The neck-furrow is practically obsolete and just in front of its normal position is a very small median pustule. The dorsal furrows are very faint except on crushed specimens. The eyes are small, strongly elevated and far apart. The palpebral lobes are small, concave on top and so short that a part of the visual surface looks upward. The genal angles are rounded and the sides of the cheeks have a narrow flattened and striated border which stands at an angle with the general surface and is turned downward at the sides and front. This joins the nearly horizontal doublure in a sharp edge.

Axial lobe of thorax wide, but less than one half the entire width.

Pygidium not quite twice as wide as long, the narrow axial lobe faintly but definitely outlined, most prominent at the posterior end. Pleural lobes smooth.

Measurements:— The entire specimen selected as the type is 58 mm. long and 33 mm. wide at the genal angles. The cephalon is 18.5 mm. long, the eye 5 mm. long, and the back of the eye 6 mm. from the posterior margin of the head. The thorax is 20 mm. long, 32 mm. wide at front and 32 mm. wide at back. The axial lobe is 15 mm. wide at front and 13.5 mm. wide at back. The pygidium is 19.5 mm. long, 32 mm. wide at the front. The axial lobe is 15 mm. long.

Homotelus obtusus (Hall) of the Chazy differs from this species in having more strongly impressed furrows and particularly in its very conspicuously punctate shell. *Homotelus simplex* (Narraway and Raymond) is much more closely like the present one but has the eyes larger and further back, more traces of ribs on the pygidium, and lacks the angulated border on the cephalon.

Horizon and Locality:— This species seems to be quite common in the Eden in the vicinity of Cincinnati, Ohio, but as the specimens are all in the Dyer collection I have no data on either exact horizon or locality. Cotypes M. C. Z. 1,575, 1,576.

Homotelus elongatus, sp. nov.

Onchometopus simplex Bassler (*non* Raymond and Narraway), Maryland geol. sur., Cambrian and Ordovician, 1919, p. 348, pl. 47, fig. 11.

Test large for the genus, elongate, both shields subtriangular, strongly convex. Cephalon subtriangular, less than twice as wide as long, evenly convex. Glabella smooth, not outlined, dorsal furrows present only back of the eyes and glabellar furrows obsolete. Eyes prominent, situated a little back of the middle but more than their length ahead of the posterior margin. Genal angles rounded.

Thorax abruptly deflected at the sides, depressed convex on top. Axial lobe less than one half the total width.

Pygidium triangular, strongly and evenly convex, the axial lobe hardly outlined except at the posterior end. Exfoliated specimens show traces of several ribs on the pleural lobes.

Measurements:— One entire but much damaged specimen is about 105 mm. long and 60 mm. wide at the genal angles. A well-preserved pygidium is 44 mm. long and 63 mm. wide. A smaller one is 36 mm. long and 51 mm. wide.

This species is readily recognized by its highly convex triangular shields. The axial lobe of the pygidium is also less strongly defined than in most other species.

Horizon and Locality:— A very common species in the lower Echinosphaerites zone of the Chambersburg in the vicinity of Chambersburg and Marion, Penna. and Strasburg, Va. Bassler reports it from the Nidulites zone of the Chambersburg at Wilson, Md. Cotypes M. C. Z. 1,577 to 1,579.

Homotelus indentus, sp. nov.

This species is so far represented only by pygidia but these differ obviously from the majority of species of the genus in their more elongate form and the upturned posterior border. The axial lobe is long, narrow, gently tapering, and prominent. The pleural lobes ribless, evenly convex. Back of the axial lobe the posterior margin is upturned, so that in this region there is a concave border. This upward tilt in the posterior margin suggests a somewhat pointed cephalon. The surface of the test is covered with small flat-bottomed circular depressions which are arranged about as closely together

as they can be and still retain their circular shape. They appear to be very large but superficial puncta. Along the borders these are less numerous, and among them are numbers of short wavy cracks roughly parallel to the margin. Exfoliated specimens of course show no trace of this ornamentation but do show faint traces of ribs on the pleural lobes.

Measurements:— The largest pygidium is 43 mm. long and 57 mm. wide. The axial lobe is 35 mm. long and 17 mm. wide at the front. A second specimen is 33 mm. long and 45 mm. wide. The ratio of length to width indicates the elongation of the pygidium in this species. This index in *H. ulrichi* which is more like *H. indentus* than any other described species is about 610, in *H. obtusus* it is 655 to 680, in *H. elongatus*, which has a long pygidium it is about 700, while in the largest specimen of *H. indentus* it is 754.

Aside from the length of the pygidium and the upturned posterior margin, the character of the ornamentation serves to identify this species.

Horizon and Locality:— This seems to be a rather rare species, found so far only in the Holston in the Catawba Valley, north of Salem, and on the Hoge farm, nine miles southwest of Bland, Va. The specimens from this latter locality were collected by Dr. E. W. Shuler. Cotypes M. C. Z. 1,581, 1,582.

Homotelus laevis, sp. nov.

This name is suggested for a species, the pygidia of which are common and of which a few fragmentary cranidia and free cheeks have been seen. In general outline and proportions the pygidium is most like that of *H. obtusus* but the axial lobe is more strongly developed and the puncta are much fewer, finer, and farther apart. There is also a faint concave border on the posterior part. The cranidium is very slightly convex, the eyes large and well back. The cephalon is in fact much more typically isoteliform than that of any other species. Exfoliated or compressed specimens show rather plainly the ribs of the pygidium.

Measurements:— A small pygidium is 22 mm. long and about 35 mm. wide. The axial lobe is 16 mm. long and 11 mm. wide at the front. A large specimen (flattened) is 45 mm. long and about 70 mm. wide.

This species is exceedingly common in the Athens at Chatham Hill, on the northern slope of Walker Mountain, north of Marion, Va. It is

also found in the same formation near White Gate and Tilsons Gap, Bland Co., and in the Holston near McDonalds Mills in the Catawba Valley, north of Salem, Va., in all of which localities it was collected by Dr. E. W. Shuler; and also in the Holston at the McNutt quarry, Sharon Springs, Va. A single large pygidium collected by the writer in the Athens near Saltville, Va., is probably of this same species. In the lower part of the Athens near Bull's Gap, Tenn., the species is quite common. Holotype M. C. Z. 1,600.

Homotelus laeviurus, sp. nov.

This species has a short broad cranidium, of little convexity, on which the glabella is entirely merged into the general surface, and dorsal and glabellar furrows quite absent. The median pustule is small but prominent on the otherwise smooth surface, and the shell seems devoid of puncta. The free cheeks and thorax are unknown.

The pygidium is evenly convex and the only marking is a very slight swelling indicating the position of the posterior end of the axial lobe. Even in internal casts the outline of the axial lobe shows only vaguely.

Measurements:— A cranidium is 17 mm. long and 24 mm. wide at the tips of the fixed cheeks. At the widest point in front of the eyes it is 16 mm. wide. Another cranidium is 11.5 mm. long, 16 mm. wide at the tips of the fixed cheeks, and 9.5 mm. wide at the palpebral lobes. A pygidium is 14 mm. long and 19 mm. wide.

This species is more nearly allied to *Homotelus simplex* Raymond and Narraway than to any other described species, but has smoother shields, and the pygidium in particular shows less trace of the axial lobe. The absence of puncta in the shell separate it from *H. obtusus*, the only other species with which it could be confused.

Horizon and Locality:— A very common trilobite in the Kimmswick limestone at Mincke, Mo., where it was collected by Dr. D. C. Barton. Cotypes M. C. Z. 1,584, 1,585.

Homotelus catactus, sp. nov.

The only representative of this genus so far found on Newfoundland is a single cranidium which does not seem referable to any of the described species.

This specimen indicates a short and wide cephalon which was evenly arched and rather convex for the genus. The glabella is merged completely into the general surface, and both dorsal and glabellar furrows are completely absent. The facial sutures turn far outward in front of the eyes, so that this portion of the cranidium is wider than in any other species of the genus. The palpebral lobes are large, indicating very large eyes, and are situated a little more than their own length in front of the posterior margin, but not quite twice their length from the anterior edge. The surface, so far as can be determined from a largely exfoliated specimen, is smooth.

This species differs from any previously described, in having larger eyes and in the greater width of the portion of the cranidium in front of them.

Measurements:— Length of cranidium, about 32 mm., width at palpebral lobes, 32 mm. Length of palpebral lobe, 8 mm., distance from back of palpebral lobe to posterior margin, 11 mm.

The single specimen was collected by Professor Dunbar from a pebble in the Cow Head conglomerate on Stearing Island, Newfoundland, and is in the Yale University Museum.

Homotelus gratiosus, sp. nov.

Asaphus (*Isotelus*) *susae* Whiteaves (*non* Whitfield), Palaeozoic foss. Canada, 1897, **3**, pt. 3, p. 231.

Onchometopus susae Raymond, Proc. and trans. Roy. soc. Canada, 1912, ser. 3, **5**, sect. 4, p. 118, pl. 2, fig. 1, 2.

Cephalon nearly semicircular, evenly convex, with large, elevated eyes. Cranidium absent from the type, but on other specimens depressed, smooth, glabella not outlined. Fixed cheeks smooth, genal angles rounded. Eyes large, near the middle of the cephalon.

The axial lobe of the thorax is wide for an Homotelus, being nearly one half the total width.

Pygidium short and wide, nearly semicircular, with the axial lobe outlined at the anterior end only.

Measurements:— Length of cephalon, 25 mm., width, 51 mm., the eye is 10 mm. long. Total width of thorax at middle, 48 mm., width of axial lobe, 23 mm. Length of pygidium, 26 mm., width 46 mm.

This species differs from *Homotelus florencevillensis*, which occurs at the same horizon, in having the eyes much farther forward and

larger, as well as in the shorter and wider shields. It differs from other known species of the genus in the same particulars.

Horizon and Locality:— The holotype, a gift of Mr. A. H. Becker and Mr. John H. Bradley, Jr., M. C. Z. 1,573, was found near the top of the Maquoketa at Patterson's Spring, near Brainerd, Iowa.

Vogdesia Raymond.

Although proposed as a subgenus of Nileus, Vogdesia proves to be one of the Asaphinae, and closely related to Homotelus and Brachyaspis. This conclusion has been reached from a study of the dorsal surface, as the hypostoma has not yet been seen. Vogdesia differs from both the genera mentioned in having a wider axial lobe in the thorax, and little or no trace of dorsal furrows on the pygidium. The type is *Vogdesia bearsi* Raymond, from the Chazy. Other species are *Vogdesia minnesotensis* (Foerste) and Nileus sp. (Foerste, Bull. Denison univ., 1920, **19**, p. 218, pl. 23, fig. 4A, B) both from the Trenton, and *Vogdesia vigilans* (Meek and Worthen), a common trilobite in the Maquoketa.

Vogdesia gigas, sp. nov.

This species differs from *V. vigilans* only in that the type is twice as large as the largest known specimen of the latter, the eyes are farther from the anterior margin, and the test is slightly if at all punctate.

Measurements:— Specimen, if extended, about 120 mm. long. The cephalon is 34 mm. long and 58 mm. wide; an eye is 8 mm. long and 8 mm. from the posterior margin. The pygidium is 36 mm. long and 55 mm. wide, with no trace of an axial lobe. The thorax is estimated to be about 50 mm. long, each of the eight segments being 7 mm. wide in the enrolled state.

Horizon and Locality:— This species is known from a single specimen collected by the writer near the base of the Maquoketa on a creek four miles west of Clermont, Iowa. Holotype, M. C. Z. 1,589.

Ectenaspis, gen. nov.

Type, *Megalaspis beckeri* Slocum, Field mus. nat. hist. Geol. ser., 1913, **4**, p. 50, pl. 14, fig. 5. Iowa Geol. survey, 1916, **25**, p. 196, pl. 15, fig. 5.

Several years ago Mr. A. G. Becker, while collecting in the ravine of a small stream about two miles west of Clermont, Iowa, came upon a slab of limestone on which were two specimens of the trilobite which Slocum later described as *Megalaspis beckeri*. The outstanding feature of this animal is the great elongation of the anterior portion of the cephalon. The elongate triangular head-shield invited a comparison with such asaphids as *Megalaspis extenuata* (Dalman), hence the generic reference.

No one has as yet been fortunate enough to discover an hypostoma of this species, so that it is not possible to say definitely that *M. beckeri* is not a Megalaspis, but that it is almost certainly not one is indicated by the following considerations:—

1st. Nearly all the species of Megalaspis in the typical region in northern Europe are found in the Lower Ordovician, only one or two surviving till the Middle Ordovician, and none till the Upper Ordovician rocks were deposited.

2nd. Megalaspis is exceedingly rare in America, while isotelids are common and highly variable.

3rd. No hypostoma of the ogygiocarinid type has been found in the Maquoketa.

4th. The glabella of *Megalaspis beckeri* is not definitely outlined and is long, while in all species of the true Megalaspis the glabella is outlined and is relatively short.

5th. The axial lobe of the thorax of *M. beckeri* is wider in proportion to the total width than is that of any species of the true Megalaspis.

In consideration of the above, I make *Megalaspis beckeri* the type of a new genus, Ectenaspis, the extended or stretched out character of the cephalic shield suggesting the name. This genus seems very close to Isotelus, and its derivation from Isoteloides through some such forms as *I. angusticaudus* Raymond and *Ectenaspis homalonotoides* (Walcott) is quite probable.

Ectenaspis beckeri is an exceedingly rare fossil in the lower part of the Maquoketa (Upper Ordovician) in Fayette Co., Iowa. The only other species which can now be placed in this genus is *Ectenaspis homalonotoides* (Walcott).

Isotelus annectans sp. nov.

Isoteloides homalonotoides Raymond and Narraway (*non* Walcott), Ann. Carnegie museum, 1910, **7**, p. 52, pl. 16, figs. 9–11.

This name is proposed for the species previously identified with "*Asaphus*" *homalonotoides*. Both cephalon and pygidium are similar to those of that species, but the anterior end of the cephalon is hardly elongate enough to justify a reference to Ectenaspis. It also seems better to restrict Isoteloides to forms like the type, *I. whitfieldi*, which has a rather distinctly outlined glabella and a narrow axial lobe.

This species forms a connecting link between Isotelus and Ectenaspis. The anterior end of the cranidium, while not elongate, is pointed, and though the glabella is not definitely outlined, some traces of its shape can be seen, and a pair of faint glabellar furrows are present on some specimens.

Horizon and Locality:— A single cranidium of this species was found by Mr. Narraway in the Leray-Black River at Ottawa, Ont., and it is fairly common in the Glens Falls-Trenton at Pattersonville and Smith Basin, N. Y. The holotype is in the Carnegie Museum.

Isotelus rejuvenis, sp. nov.

Entire specimen elongate oval, narrow, strongly convex. Cephalon large, with short genal spines which in uncrushed specimens have their outer surfaces nearly vertical. The facial sutures follow the same course as in *I. iowensis*, being very close to, and parallel to the anterior margin. The eyes are very small, elevated, situated a trifle more than their own length in front of the posterior margin. The glabella is faintly outlined, constricted between the eyes, and nearly smooth.

Thorax as in *I. iowensis*, the dorsal furrows shallow, and the axial lobe more than one third and less than one half the total width.

Pygidium elongate, narrow, with steep sides. The axial lobe is narrow, faintly outlined except in young specimens, and without rings except for the one on the anterior end. The pleural lobes show traces of several pairs of ribs, two of which at the anterior end are very distinct.

Measurements:— The holotype is 105 mm. long; the cephalon is 38 mm. long and 62 mm. wide; the pygidium is 46 mm. long and 55 mm. wide.

This species differs from *Isotelus iowensis* in having smaller eyes, a longer and narrower pygidium with two pairs of ribs at the anterior end, and in having a less densely punctate shell.

Horizon and Locality:— The species has so far been found only in the lower part of the Maquoketa at Clermont and Elgin, Iowa, at both of which places it is rather common in association with *I. iowensis*. The holotype, M. C. Z. 1,586, was collected by the writer on a creek about four miles west of Clermont.

Encrinuridae Angelin.

Ectenonotus, gen. nov.

Among the anomalous trilobites described by Billings was one which had a glabella very like that of a Pliomerops, and a pygidium strongly suggestive of Encrinurus. Although no entire specimens have been reported the "glabella and pygidium were found in about equal numbers together, and in great abundance. Out of one small piece of rock scarcely a yard in length, there were taken twenty-seven specimens of the glabella, and twenty-four of the pygidium. In this mass of rock there was no other head to which the pygidium could be referred, nor any other pygidium to which the head could possibly have belonged."

The pygidium is distinctly Encrinurus-like in its elongate narrow form, very long axial lobe with numerous rings, and particularly in the way in which the posterior ribs on the pleural lobes curve back around the end of the axial lobe. The pygidium shows some differences from both Encrinurus and Cybele, but they are of a relatively minor character, and if it were not for the associated cranidium, the species would undoubtedly be admitted to the genus Encrinurus.

While the cephalon is Pliomerops-like, certain Encrinurid characteristics may be seen in it, particularly when compared with Cybele. The form of the glabella and position of the glabellar furrows is similar to what is seen in *Cybele bellatula* (Dalman) (Schmidt, Mem. Acad. imp. sci. St. Petersburg, 1881, ser. 7, **30**, p. 203, pl. 13, fig. 9) and the glabella does not expand toward the front as in Pliomerops. The most important point, however, is that the eye is not situated close to the glabella as in Pliomerops. The eye is not shown in any of the specimens but enough of the fixed cheek is preserved to indicate that, whether the eye is ultimately found to be far forward, as in Encrinurus and some species of Cybele, or far back as in other species of that genus, it must at least be placed at some distance from the glabella and thus be Encrinurid in position.

Billings made the cranidium the holotype of the species *Amphion westoni*, so that in case it should prove that the cranidium and pygidium do not belong together, the pygidium will belong to an unnamed species. I propose to designate the specimen from Newfoundland retaining the thorax and pygidium as the holotype of the genus, in order that there may be in the future no uncertainty as to how the names should apply.

Encrinuridae with pygidia whose simple pleural ribs do not end in spines, and whose glabellae have a pair of furrows which emerge on the front instead of the lateral border.

Type, *Ectenonotus westoni* (Billings).

Another species is *E. octocostatus* (Reed) from Glensaul district in Ireland.